Virtual Goat

Created on: 10-02-2023 - Last modified on: 13-02-2023

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SCOPE OF THE METHOD
The Method relates to | Animal health
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The Method is situated in | Translational - Applied Research
Type of method | In silico
Species from which cells/tissues/organs are derived | Capra aegagrus hircus
Type of cells/tissues/organs | Muscle, fat, intestines’ content and tissue, bone

DESCRIPTION

Method keywords
- computational models
- in silico analysis

Scientific area keywords
- electromagnetic simulations
- Antenna Design
- computational modelling

Method description
Full-wave electromagnetic (EM) simulations solve the laws of Maxwell for a given problem. When designing a wireless solution for an Internet of Animal Health (IoAH) application, multiple iterations are needed to achieve well-defined metrics such as energy efficiency, electrical and mechanical robustness against environmental changes and reproducibility. When considering in-body devices, the surrounding tissue will electromagnetically couple with the radiating in-body antenna. Therefore, to optimize the antenna, the body of the animal and its electromagnetic properties must be well characterized and digitalized. The characterization is done by measuring the electrical permittivity and permeability of bulk tissue (Gabriel, 1996). To construct the heterogeneous model of the animal, a slaughtered animal was measured and expertly drawn in computer aided design (CAD) software. This model
of the animal, together with the measured tissue properties, can be imported in the full-wave electromagnetic solver. In this *in silico* environment, multiple iterations and placements can be tried out at a low cost and without any extra test animals. Once the above defined metrics are achieved, only validation tests are left to be performed on test animals.

**Lab equipment**

- Electromagnetic solvers (CST, Sim4Life, COMSOL, HFSS,...)
- Computation cluster

**Method status**

- Internally validated

**PROS, CONS & FUTURE POTENTIAL**

**Advantages**

- Cost reduction
- Reduction *in-vivo* and *in-vitro* experiments
- Improved understanding of underlying mechanisms
- Generalization of the results by digitally varying the model

**Challenges**

- Validation of model assumptions / predictions / results still required a small set of test animals;
- Simplified body model can have unforeseen consequences.

**Modifications**

- The current method is described for goats. It can easily be extended to other animals.

**Future & Other applications**

- With the increased interest in automatic farming and IoAH, the demand for wireless in-body development will increase. This method will decrease significantly the need of test animals in the coming decade during the maturing of this technology.